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EXAMINER

LUU, CUONG V

ART UNIT PAPER NUMBER

2128

DATE MAILED: 05/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/729,637

Applicant(s)

YU, JIUN-DER

Examiner

Cuong V. Luu

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 7-9, and 12-17 is/are rejected.
- 7) ☒ Claim(s) 5, 6, 10, 11, 18 and 19 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>12/5/03</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claims 1-19 are pending. Claims 1-19 have been examined. Claims 5-6, 10-11, and 18-19 have been objected. Claims 1-4, 7-9, and 12-17 have been rejected.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Section 2106 [R-2] (Patentable Subject Matter - Computer-Related Inventions) of the MPEP recites the following:

- “In practical terms, claims define nonstatutory processes if they:
 - consist solely of mathematical operations without some claimed practical application (i.e., executing a “mathematical algorithm”); or
 - ***simply manipulate abstract ideas***, e.g., a bid (*Schrader*, 22 F.3d at 293-94, 30 USPQ2d at 1458-59) or a bubble hierarchy (*Warmerdam*, 33 F.3d at 1360, 31 USPQ2d at 1759), ***without some claimed practical application***.”

An invention which is eligible for patenting under 35 U.S.C. § 101 is in the “useful arts” when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a “useful, concrete and tangible result.” The test for practical application as applied by the examiner involves the determination of the following factors:

(1) “Useful” - The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished.

(2) “Tangible” - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. § 101. In *Warmerdam* the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium, which enabled its functionality to be realized.

(3) “Concrete” - Another consideration is whether the invention produces a “concrete” result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. § 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.

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Claims 1-3, 5-6 are rejected under 35 U.S.C. 101 because the claimed invention is drawn to non-statutory subject matter. The Examiner submits that Applicants have not recited any limitations relating to a practical application in the technological arts and have merely claimed a manipulation of abstract ideas (see MPEP 2106).

1. As per claim 1, the Examiner respectfully submits, under current PTO practice, that the claimed invention does not recite either a useful, concrete, or tangible result and is merely drawn to a manipulation of abstract ideas.
 - The invention is not useful since the claimed "A method for simulating and analyzing fluid ejection ... comprising" does not recite a result (post process) or what to be done with the simulation and analysis that is useful in the technological art. This makes it difficult to determine the Applicant's invention since it merely claims a manipulation of abstract ideas. (The patent eligibility standard requires significant functionality to be present to satisfy the useful result aspect of the practical application requirement. See *Arrhythmia*, 958 F.2d at 1057, 22 USPQ2d at 1036.)
 - The claim is not tangible since the result of the method for simulating and analyzing fluid ejection is undefined.
 - The claim is not concrete because the results are not assured.
2. Dependent claims 2-3, 5-6 inherit the defect as being dependent from independent claim 1.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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Claims 5-6, 10-11, 18-19 are rejected under 35 U.S.C. 112, 2nd paragraph due to being indefinite.

3. Regarding claims 5, the phrase "each node within one cell" renders the claim indefinite because the claim includes element "node" not actually defined in the claim, thereby rendering the scope of the claim(s) unascertainable. See MPEP § 2173.05(d).
4. Regarding claims 6, the phrase "each node not within one cell" renders the claim indefinite because the claim includes element "node" not actually defined in the claim, thereby rendering the scope of the claim(s) unascertainable. See MPEP § 2173.05(d).
5. Regarding claims 10, the phrase "each node within one cell" renders the claim indefinite because the claim includes element "node" not actually defined in the claim, thereby rendering the scope of the claim(s) unascertainable. See MPEP § 2173.05(d).
6. Regarding claims 11, the phrase "each node not within one cell" renders the claim indefinite because the claim includes element "node" not actually defined in the claim, thereby rendering the scope of the claim(s) unascertainable. See MPEP § 2173.05(d).
7. Regarding claims 18, the phrase "each node within one cell" renders the claim indefinite because the claim includes element "node" not actually defined in the claim, thereby rendering the scope of the claim(s) unascertainable. See MPEP § 2173.05(d).

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8. Regarding claims 19, the phrase "each node not within one cell" renders the claim indefinite because the claim includes element "node" not actually defined in the claim, thereby rendering the scope of the claim(s) unascertainable. See MPEP § 2173.05(d).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-4, 7-9, 12, 14-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicants' admitted prior art, page 2 of current specification and the background discussion in the application 10/390239 that is incorporated by reference on pp. 1-3, in view of Trebotich et al (A projection Method for Incompressible Viscous Flow on Moving Quadrilateral Grids, Journal of Computational Physics 166, 191-217, 2001) cited by

cited by applicant and Tsukanov et al (A Meshfree Method for Incompressible Fluid Dynamics Problems, Copy Right 2002 by Spatial Automation Laboratory).

1. As per claim 1, the applicants' admitted prior art teaches a method for simulating and analyzing fluid ejection from a channel having a boundary between a first fluid that flows through, and is ejected from, the channel and a second fluid, the method comprising:
 - simulating the ejection of the first fluid from the channel using a level set projection algorithm (p.1, lines 27-29; p. 2, lines 1-3) that includes
 - (1) creating a quadrilateral grid in a physical space (appl. 10/390239, p. 2, lines 4-8, 20-23),
 - (3) solving equations governing the first and second fluids (appl. 10/390239, p. 2, lines 4-8, 20-23),
 - re-distancing, periodically during the simulation, the level set for the first and second fluids (p. 1, lines 28-29; p. 2, lines 1-1-3 of the current application),
 - But does not teach:
 - (2) calculating a transformation matrix for transforming equations derived with respect to the quadrilateral grid for application to a uniform square grid in a computational space, the level set being performed by selectively reduced bi-cubic interpolation.
- Trebotich et al teach limitation (2) (p. 191, the abstract paragraph. Trebotich et al's teachings of transforming equations derived with respect to the quadrilateral grid for application to a uniform square grid in a computational space suggest a transformation matrix must be calculated for the transformation to be performed) but do not teach the level set being performed by selectively reduced bi-cubic interpolation.

Tsukanov et al teach this feature (p. 1, the abstract, lines 2-4; p. 3, paragraph 1, lines 2-3; p. 17, the last paragraph, lines 4-5).

It would have been obvious to one of ordinary skill in the art to combine the teachings of the applicants' admitted prior art, Trebotich et al, and Tsukanov et al. Trebotich et al's and Tsukanov et al's teachings would have enabled the solution of well-behaved linear systems amenable to the used of fast iterative methods and facilitated optimizing component designs via use of computer aided engineering simulation (Trebotich et al, p. 191, lines 11-14 of paragraph 3) and provided a technique that can be applied systematically to any and all boundary value problems using (Tsukanov et al, p. 2, paragraph 3, lines 3-4).

2. As per claim 2, the applicants' admitted prior art teaches the first fluid is ink, the second fluid is air, and the channel is representative of an ink-jet nozzle designed to be part of a piezoelectric ink-jet head (appl. 10/390239, p. 1, lines 27-28; p. 2, lines 9-11).
3. As per claim 3, the applicants' admitted prior art teaches the ejection simulating step further comprises, after creating step (1), calculating step (2) and solving step (3):
 - initializing time, current time step number, and velocity of the first fluid, and setting an interface thickness variable (current application, p. 2, lines 4-10),
 - initializing the level set for the ink-air interface (current application, p. 2, lines 4-10), and
 - calculating an inflow pressure of the ink for the current time step (appl. 10/390239, p. 2, lines 2-4).

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4. As per claim 4, the applicants' admitted prior art teaches after solving step (3) and before re-distancing step (4), updating the level set (current application, p. 1, lines 27-28; p. 2, lines 1).
5. As per claim 7, these limitations have already been discussed in claim 1. They are, therefore, rejected for the same reasons.
6. As per claim 8, these limitations have already been discussed in claim 2. They are, therefore, rejected for the same reasons.
7. As per claim 9, these limitations have already been discussed in claims 3 and 4. They are, therefore, rejected for the same reasons.
8. As per claim 12, the applicants' admitted prior art, Trebotich et al do not teach the simulating means comprises a program of instructions embodied in hardware.

Tsukanov et al this feature (p. 4, paragraph 1, lines 3-4. Tsukanov et al mention computer simulation result. This suggests program of instructions embodied in hardware is used).

It would have been obvious to one of ordinary skill in the art to combine the teachings of the applicants' admitted prior art, Trebotich et al, and Tsukanov et al. Tsukanov et al's teachings would have enabled the solution of well-behaved linear systems amenable to the used of fast iterative methods and facilitated optimizing component designs via computer aided engineering simulation.

9. As per claim 14, these limitations have already been discussed in claims 1 and 12. They are, therefore, rejected for the same reasons.

10. As per claim 15, these limitations have already been discussed in claim 2. They are, therefore, rejected for the same reasons.

11. As per claim 16, these limitations have already been discussed in claim 3. They are, therefore, rejected for the same reasons.

12. As per claim 17, these limitations have already been discussed in claim 4. They are, therefore, rejected for the same reasons.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over the applicants' admitted prior art, which includes the background discussion in the application 10/390239 that is incorporated by reference on pp. 1-3, in view of Trebotich et al, and Tsukanov et al as applied to claim 7 above, and further in view of Friedl et al (U.S. Pub. 2005/0114104).

13. As per claim 13, the applicants' admitted prior art, Trebotich et al, Tsukanov et al do not teach the simulating means comprises a display for visually observing the simulation.

Friedl et al teach this feature (paragraph 0075).

It would have been obvious to one of ordinary skill in the art to combine the teachings of the applicants' admitted prior art, Trebotich et al, Tsukanov et al, and Friedl et al. Friedl et

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al's teachings would have provided simulation results in graphical and other formats (paragraph 0075).

Allowable Subject Matter

Claims 5-6, 10-11, and 18-19 are objected to as being dependent upon a rejected base claims but would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

14. As per claims 5, 10, and 18, they are objected to as being dependent upon rejected independent claims 1, 7, and 14, respectively, but would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the independent claims 1, 7, and 14, respectively.

15. As per claims 6, 11, and 19, they are objected to as being dependent upon independent claims, 1, 10, and 18, respectively, but would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the independent claims 1, 7, and 14, respectively and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

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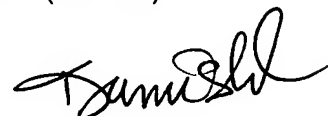
16. As per claims 5, 10, and 18, the prior arts do not teach calculating new level set values at each node within one cell from an interface between the first and second fluid as recited in the claimed invention.
17. As per claims 6, 11, and 19, the prior arts do not teach the limitations in claims 5, 10, and 18, which they, respectively, depend on, and calculating new level set values at each node not within one cell from the interface using triangular fast marching method as recited in the claimed invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cuong V. Luu whose telephone number is 571-272-8572. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah, can be reached on 571-272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. An inquiry of a general nature or relating to the status of this application should be directed to the TC2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



KAMINI SHAH
SUPERVISORY PATENT EXAMINER

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